Detection of MRI Imaged Brain Tumors Using EfficientNet-Based Convolutional Neural Networks

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There are approximately 40 million imaging diagnostic errors annually worldwide (Itri, et al, 2018). Roughly 795,000 people in the U.S. alone die or are permanently disabled due to misdiagnosis. The rise of computational methods in recent years such as artificial intelligence and deep learning are promising approaches that demonstrate high accuracy for object-image recognition. Neural networks are an application of deep learning made up of layers of neurons. Neural Networks learn by deciphering complex patterns in data and iteratively updating their parameters using an optimizer that minimizes their loss function so that they can ultimately make intelligent decisions without human assistance. This paper aims to utilize convolutional neural networks, which are neural networks that apply convolutional operations for image recognition, to detect 44 different classes of brain tumor images. A 4479 image dataset from Kaggle consisting of 44 classes of brain tumor MRI images was used. In my research, three convolutional neural network base architectures were used - EfficientNet b0, EfficientNet b5, and EfficientNet b7 (using Tensorflow) - along with batch sizes of 32 or 64 and learning rates of 0.001 and 0.01, with all 12 combinations trained and tested on MRI images. I also implemented various overfitting prevention methods to improve model accuracy. The model with the Efficient b5-based architecture with a batch size of 64 and learning rate of 0.001 achieved the optimal result, with an accuracy of 94%.